Compost Quality & Uses

Robert Rynk

So, what *is* compost?

Soil-like material -- the “remains” of the decomposition of diverse organic raw materials or “feedstocks”

- Aerobic … at least in the end
- Alive, rich in OM and organisms
- AKA: *humus* … but it is not the same as soil humus

Compost is not ONE Product

Photo Source (PS):
BioCycle

Compost Quality & Qualities

- What are you after?
- What can you produce?

Compost Quality Factors
(in order of importance)

- End use and markets
- Feedstocks
- Processing
  - Composting (maturity, N loss)
  - Grinding, screening, sorting

Compost quality must be defined in comparison to its use

A compost good for one use may be bad for another, and vice versa

PS: Michele Young

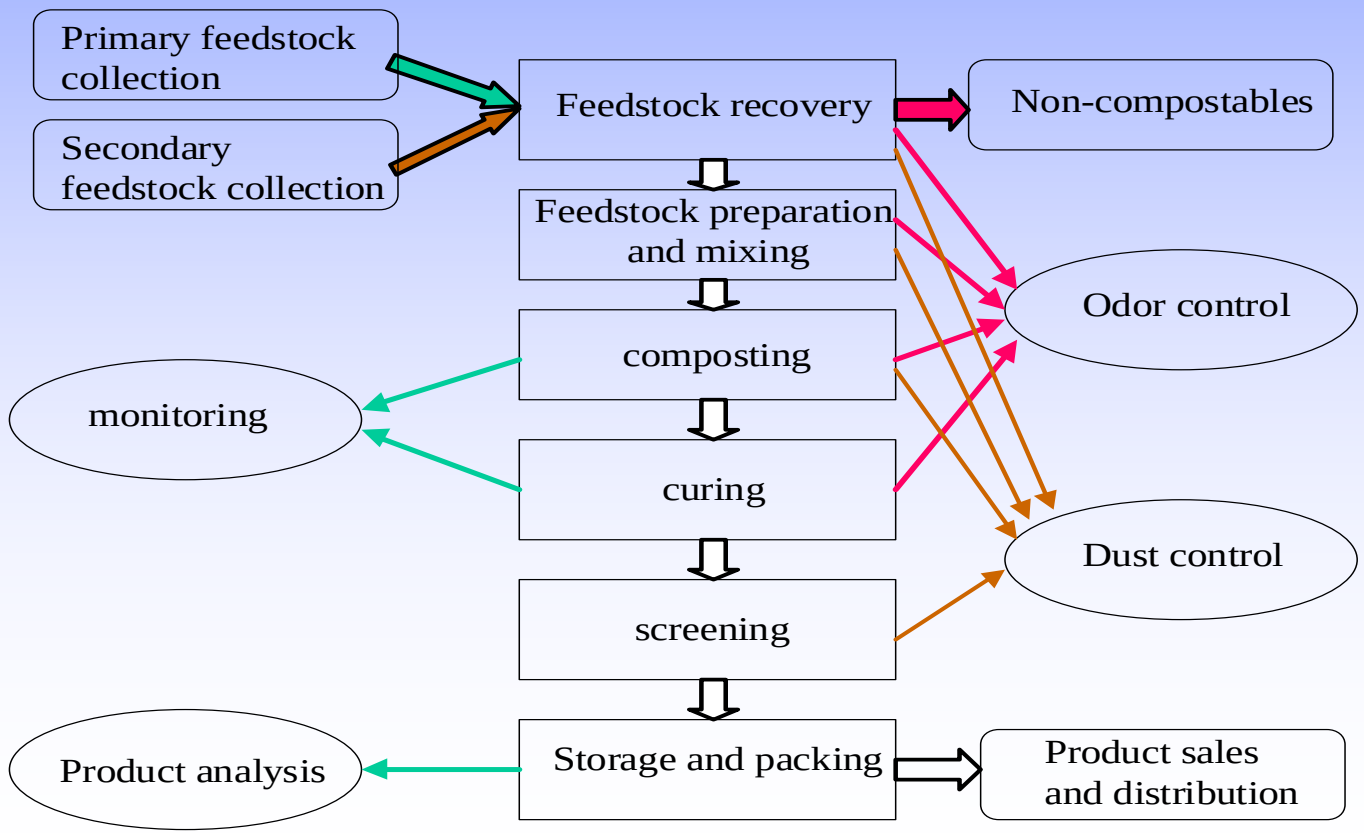
PS: David Granatstein

What determines compost quality?

- Raw materials: "garbage in, garbage out"

What determines compost quality?

- Composting practices



Quality Parameters (Qualities)

- Nutrients/elements – often minor, can be of major, importance
  - N
  - P & K
  - NPK balance
  - Micronutrients
  - Heavy metals

Quality Parameters (Qualities)

- Chemical
  - pH
  - SALTS
  - Contaminants (e.g. pesticide residues)
- Biological
  - Organic matter
  - Microflora composition
  - Pathogens

Lingering issue: Clopyralid and Picloram

- Dow: Stinger, Confront, Transline, others
- First detected in Washington, Penn., NZ
- Effective at 3 parts per billion
- Effective after 18 months in compost pile
- Simple bioassay can detect possible contamination
- Residential use banned in CA, WA

Quality Parameters (Qualities)

- Physical
  - Moisture
  - Particle size, texture
  - Particle size distribution
  - Bulk density
  - Color
  - Inert/foreign materials (plastic, sharps, metal, wood pieces …)

Quality Parameters (Qualities)

"Usefulness"

- Stability
- Maturity

Compost Analysis Samples

7 Samples

Charac.	Ave.	Median	Range
N	1.07	0.84	0.41 – 2.5
P	0.30	0.27	0.12 – 0.86
K	0.89	0.69	0.29 – 2.4
Moisture	42.3	47.1	22.3 – 53.2
Org. Matter	41.0	44.3	12.2 – 63.0
pH	7.62	7.82	6.61 – 8.23
Salts (EC)	3.07	2.47	0.93 – 6.72

Compost Analysis Samples

Charac.	OH	NY	MD
N	0.51-0.75	0.65-1.4	1.0-1.9
P	0.20-0.29	0.12-0.26	0.15-0.28
K	0.43-0.62	0.29-0.62	0.82-1.5
Moisture	31.8	53.2	47.1
Org. Matter	21.7	44.3	63.0
pH	7.38	7.30	7.82
EC	1.62	2.47	3.27
Particle Size >9.5 mm(3/8")	95.3%	79.0%	100%
Stability	Very	Stable	Very

Measuring compost quality

- What do we test for?
- What do we want to know?
  - Is is safe?
  - How do I use it?
- Sampling
  - Representative Sample is KEY
- Testing – selected labs (?)

Is it safe?

- Stability — CO_2, self heating, "baggie"
- Maturity — bioassay for phtyotoxicity

Analysis Report For:	Copy To:
Amy Cicchillo PROP PO Box 25 Bellwood Pa 16617	Cary Oshins 1010 N 13th St Allentown PA 18102

LAB ID:	SAMPLE ID:	REPORT DATE:	SAMPLE TYPE:	COUNTY:
C00164	A			Blair

RESPIROMETRY
Carbon Dioxide (CO_2) Evolution Rate

TEST PARAMETERS	
Test Dates:	6/3/03 – 6/6/03
Sample moisture % *(as received compost)*:	49.3
Sample moisture % *(for respirometry test)*:	56.8

TEST RESULTS	
mg CO_2-C/g solids/day:	0.4
mg CO_2-C/g organic matter/day:	1.1

INTERPRETATION

Respirometry (CO_2 Evolution) provides a measurement of the relative microbial activity in a compost and, hence can be used as an estimate of compost stability. The intrepretive index below from the U.S. Compost Council Test Methods for the Examination of Composting and Compost assumes optimal conditions for microbial activity are present including temperature, mositure and nutrients and that toxic components that would inhibit microbial respiration are absent.

Result*	Stability Rating	General Characteristics
< 2	Very Stable	Well cured Compost No continued decomposition No odors No potential for volatile fatty acid phytotoxicity and odor
2-8	Stable	Cured Compost Odor production not likely Limited potential for volatile fatty acid phytotoxicity and odor Minimal impact on soil carbon and nitrogen dynamics
8-15	Moderately unstable, raw compost	Uncured compost Minimal odor production Moderate to high potential for volatile fatty acid phytotoxicity Moderate potential for negative impact on soil carbon and nitrogen dynamics
15-40	Raw compost or raw organic products	Uncured Compost Odor production likely High potential for volatile fatty acid phytotoxicity and odor High potential for negative impact on soil carbon and soil nitrogen dynamics
> 40	Raw feedstocks, unstable material	Raw, extremely unstable material Odor production expected Probably volatile fatty acid phytotoxicity with most materials Negative impact on soil carbon and nitrogen dynamics expected Generally not recommended for use as compost

Is it safe?

- Salinity — electroconductivity
- Weeds — germination
- Contaminants — plastics, metals, glass
- Toxics — heavy metals, organics
  bioassay for herbicides

PS: Penn State University

PS: Penn State University

PENNSTATE

(814) 863-0841 Fax (814) 863-4540
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park PA 16802

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COMPOST BIOASSAY
Seedling Emergence and Relative Growth

TEST PARAMETERS	
Test Dates:	5/22/03 -6/2/03
Seed Type:	Cucumber-Marketmore 76 Variety
Media Type: *(Control)*	STA-Green Smart Soil Potting Mix
Vermiculite:	STA-Green Vermiculite

TEST RESULTS	
Emergence: (% of control)	101.2
Seedling Vigor: (% of control):	97.6

COMMENTS

INTERPRETATION

How do I use it?

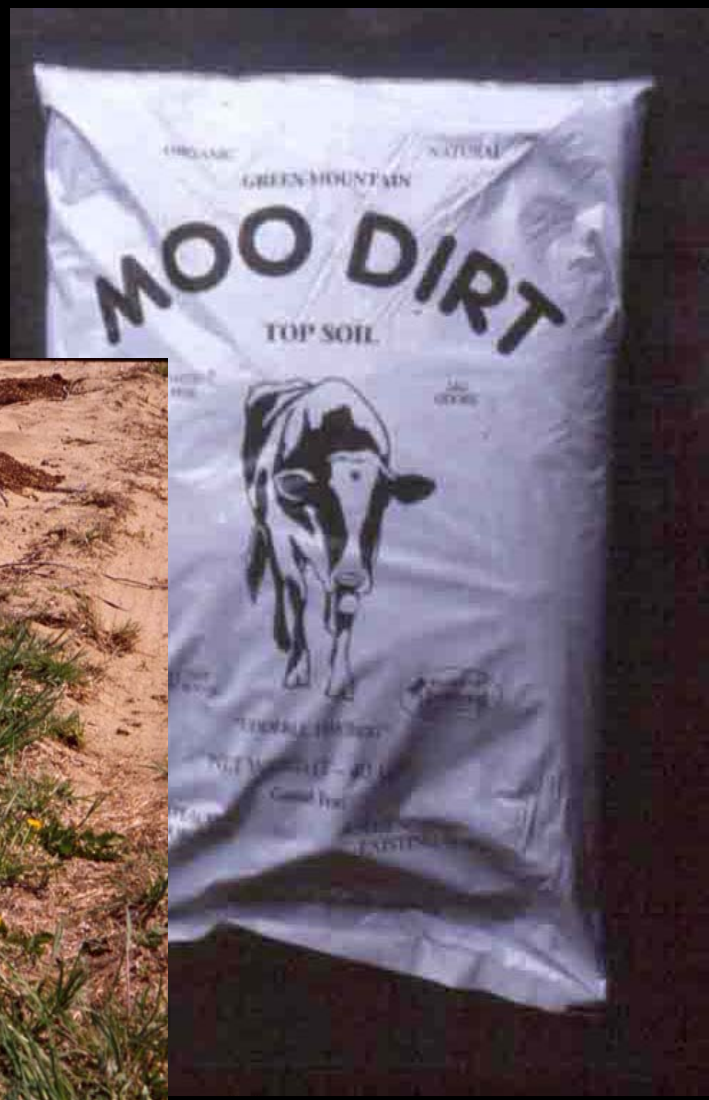
- Moisture content
- pH
- Bulk density
- Particle size distribution
- Nutrients
  - macro: N, P, K,C
  - micro: Ca, Mg, S, Zn, etc.
- Organic matter
- Soil Food Web
  - Bacteria
  - Fungi
  - Protozoa
  - Nematodes

Uses

PS: Scott McCoy

Uses

PS: Ron Alexander



PS: Vermont Natural Ag. Products

Manufactured Soil

Compost Markets and Uses

- Agriculture
  - Field crops
  - Vegetables
  - Tree fruit
  - Small fruit
  - Vineyards
  - Sod farms
- Horticulture
  - Landscapers
  - Garden centers
  - Lawn care
  - Golf courses
  - Nurseries
  - Greenhouses

Compost Markets and Uses

- Parks
- Highways
- Land reclamation
- Construction projects
- Forestry
- Mining
- Bulk materials dealers (e.g. topsoil suppliers)
- Resellers
- Retailers

Use vs. Qualities
(examples – for discussion only)

Mulch – Erosion Control – Not Planted

- Large particles
- Few small particles
- Low degradability/ moderate maturity
- Moderate salts
- Little available C
- Low nutrients (N)
- Woody -- Fiberous

Mulch Erosion Control – – Planted

- Mix of large and smaller particles
- Low degradability/ moderate maturity
- Little available C
- Moderate nutrients (N), or supplemented
- Woody – Fiberous for larger particles

Use vs. Qualities

(examples – for discussion only)

Field or Turf Soil Amendment -- Incorporated

- Mixed particles sizes
- Few large particles
- Moderate to high salts
- Moderate to low maturity
- C:N < 20
- Moderate nutrients (bonus)
- High to moderate organic matter

Topdress Turf & Field Soils Amendment

- Fine texture -- small particles sizes
- Few large particles
- Dry
- C:N < 20
- Mod. salts & maturity
- Mod. nutrients w/ high organic matter OR
- High nutrients w/ moderate organic matter

Use vs. Qualities

(examples – for discussion only)

Soil Amendment – Organic Agric. (Incorporated)

- Few large particles
- Specific feedstocks approved and prohibited (e.g. biosolids)
- C:N < 15
- Low to moderate salts
- Mod. to high maturity
- High nutrients
- High to moderate OM
- No chemical contaminants

Potting Mix Component

- Uniform particles sizes – small or large (depending)
- Dry
- High maturity
- C:N < 15
- Low salts
- Moderate maturity
- Moderate to low nutrients (depending)
- High to low OM
- Disease suppressive

Use vs. Qualities

(examples – for discussion only)

Manufactured Soil

- Small to medium particles sizes -- uniform
- Few large particles
- Moderate to high salts
- Moderate to low maturity
- Moderate to low nutrients
- Moderate organic matter
- Inexpensive
- Relatively dry
- Few visible contaminants

Land Reclamation

- Mixed particles sizes
- Large particles accept.
- Moderate to high salts
- Low maturity
- Moderate to low OM
- Mod. to low nutrients
- Very inexpensive
- Moderate physical contamination acceptable

Quality assurance programs

- USCC: Seal of Testing Assurance (STA)
  - assures testing quality, not product quality
- Rodale Press/Woods End Research Lab
  - quality seal in 6 different categories
- Other states, countries

Seal of Testing (STA) Assurance Program

WHAT IS IT?

- Compost testing and information disclosure program

PURPOSE…

- To improve customer confidence in compost selection
- To enhance compost as a mainstream horticultural, agricultural and retail product

PS: Ron Alexander

US COMPOSTING COUNCIL

Seal of Testing Assurance

Barnes – Regional Composting
3511 West Cleveland Ave.
Huron, OH 44839
Telephone: 800-421-8722
Fax: 419-433-3555

Sample Date: 8/14/20

COMPOST TECHNICAL DATA SHEET

Compost Parameters	***Reported as*** *(units of measure)*	***Test Results***	***Test Results***
Plant Nutrients:	%, weight basis	*%, wet weight basis*	*%, dry weight basis*
Nitrogen	Total N (TN or TKN+NO_3-N)	.72	1.12
Phosphorus	P_2O_5	.13	.21
Potassium	K_2O	.32	.50
Calcium	Ca	2.34	3.64
Magnesium	Mg	.57	.89
Moisture Content	%, wet weight basis	42	
Organic Matter Content	%, dry weight basis	31.31	
pH	unitless	7.4	
Soluble Salts *(electrical conductivity)*	dS/m (mmhos/cm)	3.49	
Particle Size	screen size passing through	½'	
Stability Indicator *(respirometry)* CO_2 Evolution	mg CO_2-C/g TS/day, AND	.14	
	mg CO_2-C/g OM/day	.5	
Maturity Indicator *(bioassay)*			
Percent Emergence, AND Relative Seedling Vigor	average % of control, AND	92	
	average % of control	86	
Select Pathogens	PASS/FAIL: per US EPA Class A standard, 40 CFR § 503.32(a)	Pass	
Trace Metals	PASS/FAIL: per US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3.	Pass	

Participants in the US Composting Council's Seal of Testing Assurance Program have shown the commitment to test their compost products on a prescribed basis and provide this data, along with compost end use instructions, as a means to better serve the needs of their compost customers.

Key Component

Instructions for compost use

Directions for Product Use:

***New Lawns*:** Apply a 1-2" layer to soil and incorporate to a depth of 5-7", apply seed, then rake and water.

***Flower Beds**:* Apply a 1-2" layer to soil and incorporate to a 6-8" depth. Condition soil this way every year to 2 years. Plant flowers and water.

***Trees & Shrubs**:* Dig a hole 2/3 the depth of the root ball and at least twice as wide. Mix 1 part compost with 2 parts soil obtained from the planting hole. Place the tree or shrub in the planting hole and apply amended soil around the root ball. Firm soil occasionally and water.

Topsoil Manufacturing/Upgrading: Mix 1 part compost with 2 parts existing or purchased soil and blend uniformly.

Growing Mixes: Planter box or raised bed mixes can be produced by mixing 1 part compost to 1 part pine bark and 1 part soil, sand or expanded shale. Potting mixes should contain 1 part compost, 1 part peat moss or pine bark, and 1 part perlite, vermiculite, styrofoam, or other aggregate.

***Mulching**:* Spread a 2-3" layer around trees, shrubs, and flowers. Always avoid placing mulches against plant trucks and stems.

***Garden Beds** (food crops):* Apply a 1-2" layer to soil and till to a 6-8" depth. Reapply each year, or as per soil test recommendations.

NOTE: The USCC does not assess whether or not, or to what extent, these directions are sound, sufficient or otherwise appropriate. It is the participant's responsibility alone to ensure that they are.

***Compost Ingredients**:*

Yard trimming, food by-products

This compost product has been sampled and tested as required by the Seal of Testing Assurance Program of the United States Composting Council (USCC), using certain methods from the "Test Methods for the Examination of Compost and Composting" manual. Test results are available upon request by calling (__company name__) at (__telephone__). The USCC makes no warranties regarding this product or its contents, quality, or suitability for any particular use.

For additional information pertaining to compost use, the specific compost parameters tested for within the Seal of Testing Assurance Program, or the program in general, log on to the US Composting Council's TMECC web-site at http://www.tmecc.org.

Comments?

Questions?